A STUDY ON THE VENEER RECOVERY RATE IN A PLYWOOD PLANT

W. MOHD NAZRI W. ABDUL RAHMAN[1] and MOHD ARIFF JAMALUDIN[2]
[1]Universiti Teknologi MARA, Cawangan Pahang, 26400 Bandar Jengka, Pahang
[2]Universiti Putra Malaysia, 43400 Serdang, Selangor

ABSTRACT

A research to determine the recovery rate of logs that was to be converted into plywood was done at a local factory in Kuala Terengganu, Terengganu. The objectives of the research was to determine the effect of species, diameter and log shape on the recovery rate of veneer and to evaluate the volume of residue's losses in five early stages of the veneer production line. The five stages of veneer preparation studied were logyard/deck, debarker, rotary lathe, dryer and core builder/composer. The wood species studied were Meranti (*Shorea spp.*), Gerutu (*Parashorea spp.*), Kapur (*Dyrobalanops spp.*) and Simpoh (*Dillienia spp.*). These species were the most frequently used species in the factory. From the research, it was concluded that the recovery rate of Meranti was 58.38% (*Shorea spp.*), Gerutu was 58.31% (*Parashorea spp.*), Kapur was 60.34% (*Dyrobalanops spp.*) and Simpoh was 52.35% (*Dillienia spp.*). The analysis of the results showed that there was a significant difference in recovery rate between species. On the other hand, the recovery rate of logs with a diameter above 50 cm was 58.81% and diameter below 50 cm was 55.98 percent. The difference as observed in the analysis was not significant. The research also showed that the recovery rate for log shape factor for straight logs were 62.83% and curved logs were 51.96 percent. This showed that the log shape factor significantly affected recovery rate. The result of residue losses during the five main processes indicated that logyard/deck and debarker had a residue losses of 0.58-2.40%, rotary had 13.69-14.90%, dryer had 4.72-8.49% and core builder/composer had 13.91-22.44 percent. It could be concluded that species and log shape factor contributed significantly towards the veneer recovery rate. Lastly, it could also be concluded that the core builder/composer section contributed to the highest residue losses.

INTRODUCTION

Lumber grade yield varies by species and diameter within log grades. A major objective of log classification is to separate from wood-run logs those that are suitable for the manufacture of a given product or class of product (veneer, standard lumber, ties, ect.) and, to determine the relative qualities of products obtainable from grades of logs with common surface characteristics (Rast et. al., 1971).

Plywood manufactures in Peninsular Malaysia currently rely on the supply of a limited number of traditional species for the production of face veneer (Wong, 1980). Face veneers of plywood should have a uniform colour and for core veneers, the species are not rated because it is to utilize any species that can be peeled. The species recommended for the manufacture of structural plywood should have high strength and stiffness and should be easily glued (Anon., 1976). But, with some wood

species, it is better to optimize the maximum value of the veneer instead of maximizing veneer volume.

Wood veneer is the main input for plywood manufacture. Various forms of wastes/residues are inevitably generated. The plywood and veneer manufacturing industry is unique in which each process results in diminished veneer volume. Since plywood and veneer manufacturing industry result in diminished veneer volume at each point of production, applying a method of quantifying the wood residue is desirable to increase the recovery rate. In general, these residues take the form of lilypad, round-up, spur trim and peeler core. Due to increasing cost of raw material, the direction of growth of plywood and veneer industry should be towards achieving a higher rate of recovery from logs used, as well as utilizing the log cores and other wastage to manufacture additional timber products (Nazip,1988).

Objectives

The objectives of this study were :

a) To determine the effect of species, diameter and log shape on the recovery rate of veneer.
b) To evaluate the volume wastage at five early stages of the veneer production line.

METHODOLOGY

Study Site

This study was carried out in a plywood factory which is situated in Kuala Terengganu, Terengganu.

Selection of Sample

The veneer recovery study was conducted with the aim of quantifying the recovery rate of selected wood species commonly used for the manufacture of plywood veneer. The number of treatments used was 16 treatments with 3 replications (4 x 2 x 2 x 3 replications), as indicated in Table 1 and Figure 2.

Table 1 : The Experimental Factors and Treatment Levels

Experimental Factors	Factor Levels
Wood Species	1. Gerutu (*Parashorea spp*) 2. Meranti (*Shorea spp*) 3. Kapur (*Dryobalanops spp*) 4. Simpoh (*Dillenia spp*)
Log Diameter	1. Above 50 cm 2. Below 50 cm
Log Shape	1. Straight (3 replication) 2. Curve (3 replication)

Log Sampling

In this study, a total of 48 samples of logs were selected according to the species, diameter and log shape. Four species was selected, where two species were from light hardwood and the other two were from medium hardwood . These species were the most commonly processed log species in the factory. The species are shown below :

a) Meranti (*Shorea spp.*)- Light hardwood.
b) Gerutu (*Parashorea spp.*)- Light hardwood
c) Kapur (*Dyrobalanops spp.*) - Medium hardwood
d) Simpoh (*Dillenia spp.*) - Medium hardwood

Each wood category consisted, of 24 samples, where 12 samples from each species were collected. These 12 samples were divided into two groups of diameter size which were ***above 50 cm*** and ***below 50 cm***. Then, each diameter size group was divided into two groups of log shape. The log shapes were ***straight*** and ***curve***. Figure 3.1 illustrated the proportion of 48 log samples.

Data Collection

Observations and measurements were carried out in each veneer production stage. The step by step process started from the log yard and ends at the composer and core builder sections. The production stages are as shown in Figure 1.

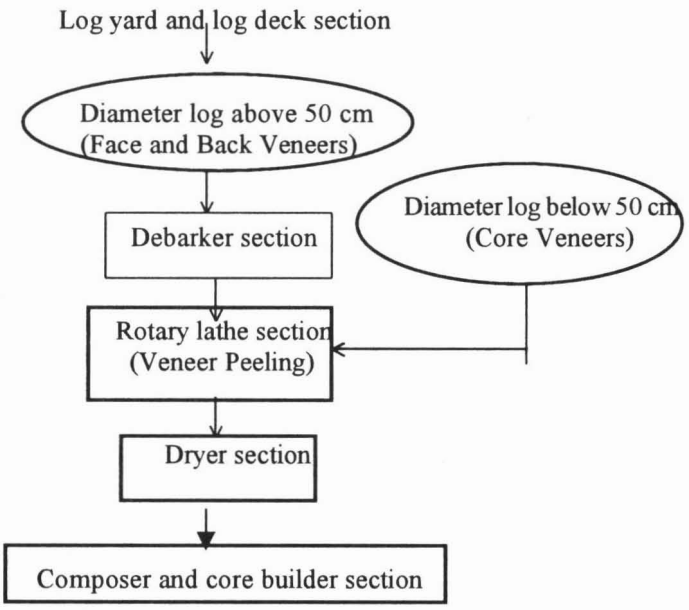

Figure 1: Five Early Stages of Veneer Production

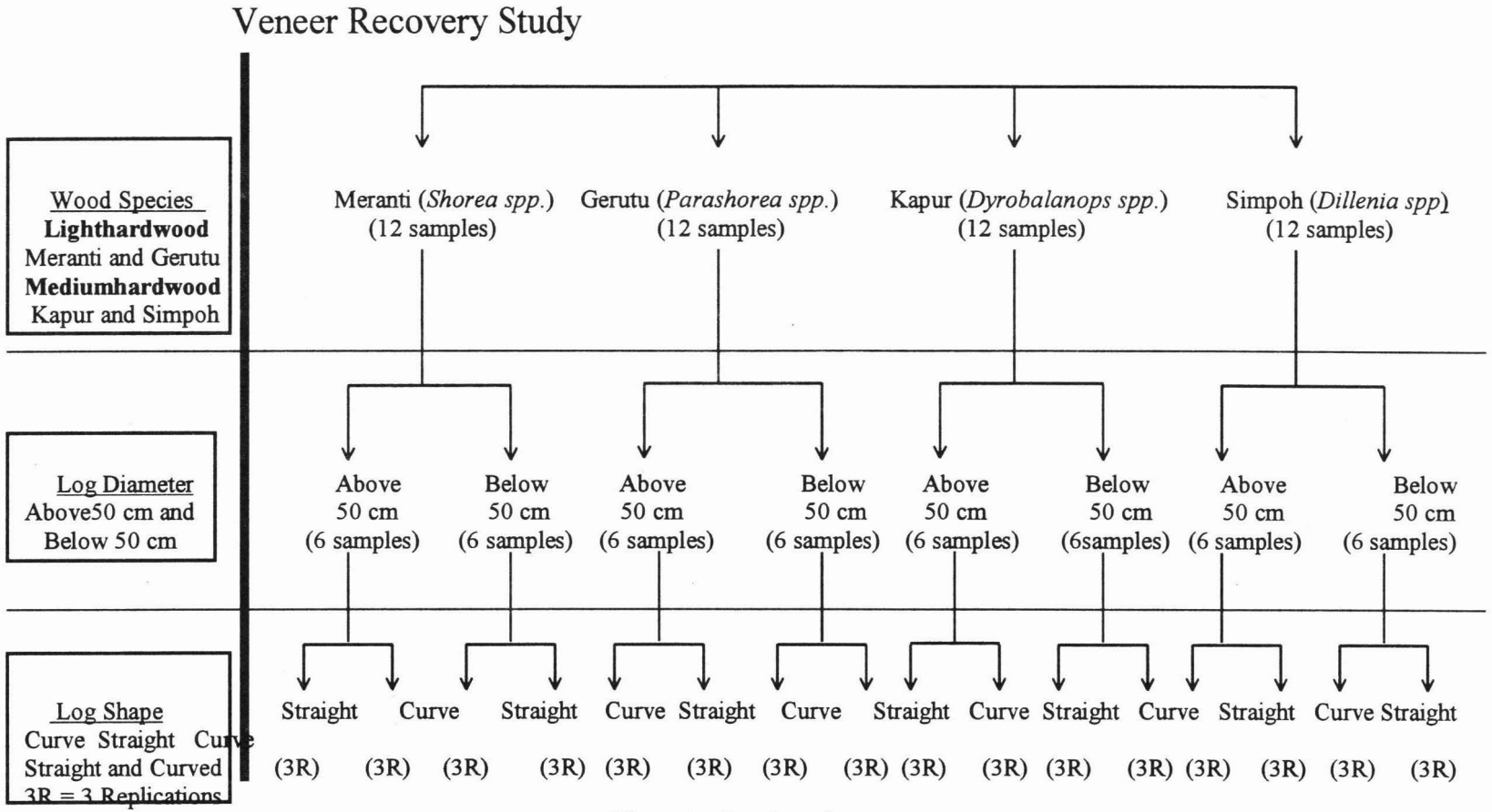

Figure 2 : Log Samples

RESULT AND DISCUSSION

Recovery by Species, Diameter and Log Shape

According to Rast et. al. (1971), the major factors that affected the quality (recovery) of factory-lumber logs were position of the log in the tree (butt or upper), size of the log (diameter), straigthness, amount and distribution of scalable defects and defect in the useable wood outside the heart center. Some tropical species are soft and easily workable, whereas others are so hard that they must be steamed prior to peeling. The great majority of standing timber in Southeast Asia is of the *meranti* group. However, there are a great number of other species (Bailey, 1975).

Recovery by Species

In this study, the determination of recovery rate of the selected wood species was based on two major wood classifications. They were Light Hardwood (Meranti and Gerutu) and Medium Hardwood (Kapur and Simpoh).

The recovery percentage by species showed a considerable variation, ranging from a low 52.35% to a high of 60.34% (Table 2).

Table 2 : Recovery by Species

Species	Recovery (%)
Meranti	58.38
Gerutu	58.51
Kapur	60.34
Simpoh	52.35

Table 3 : Least Significant Difference (LSD) Test

Mean	Species	Simpoh	Meranti	Gerutu	Kapur
52.3525	Simpoh	n/s	n/s	n/s	n/s
58.2908	Meranti	n/s	n/s	n/s	n/s
58.5142	Gerutu	n/s	n/s	n/s	n/s
60.3350	Kapur	*	n/s	n/s	n/s

Note : LSD test with significance level 0.05
* Indicates significant differences
n/s indicates not significant differences

Table 4 : Summary of Analysis of Variance

Main effect	F-value	Significance
Species	0.062	*
Diameter	0.000	n/s
Log Shape	0.007	*

Note : Analysis of Variance (Simple Factorial) with significance level 0.05
* Indicates significant differences
n/s indicates not significant differences

Meranti and Gerutu were from the same wood category which is the Light Hardwood. There were a total of 12 samples of Meranti being studied, out of 48 samples. It showed that the recovery rate of Meranti (58.38%) was lower than Gerutu (58.51%). From the analysis, the recovery of these two species were not significant. The differences in the mean values were small, as observed in Table 2.

The recovery pattern of these two species (Gerutu and Meranti) were similar This was because, Gerutu and Meranti were from the same wood species (*Shorea spp.*). Therefore, the characteristic of these two wood/log were similar. The analysis showed that, there were no significant differences between these species (Meranti and Gerutu) and the other two species (Kapur and Simpoh). Kapur was one of the species from Medium Hardwood category. From the result, it showed Kapur (60.34%) had the highest percentage of recovery, followed by Meranti (58.38%), Gerutu (58.51%) and the lowest was Simpoh (52.35%).

At the core builder section, a high amount of Simpoh veneer were rejected and cannot be used as a plywood material. Consequently, the recovery of the Simpoh species were low. The lower recovery of Simpoh was due to defects in the wood. These were, split, shakes and defects cause by powder post beetles (*Minthea rugicollis*).

Recovery by Diameter

The recovery of veneer after being classified into diameter classes were also measured. Below is the summary table for veneer recovery by diameter classes.

Table 5 : Veneer Recovery by Diameter Classes

Recovery (%)						
Diameter	Log Deck/ Yard	Debarker	Rotary	Dryer	Core builder/composer	Overall recovery
Above 50 cm	98.48	96.78	82.47	75.32	58.81	58.81
Below 50 cm	97.96	97.96*	83.45	77.80	55.98	55.98

Note : * Log below 50 cm was not debarked

The recovery of the core builder/composer section was the last stage in this study. The diameters above 50 cm recorded higher veneer recovery rate (58.81%) than diameters below 50 cm (55.98%) (Table 3).

The recovery for log above 50 cm in diameter at the log yard (98.48%) were higher than log diameter below 50 cm (97.90%). This was because, the number of cuttings from log into bolts were lower than log diameter below 50 cm. Normally, the length of bolts were from 6 ft to 8 ft. For log diameter below 50 cm, the length of bolts were cut into 3 ft to 4 ft. This cutting procedure resulted in higher number of cuttings for logs of diameter below 50 cm compared to those logs of diameter above 50 cm.

In a study to determine veneer yields of four southern hardwoods species, Clark and McAlister (1984) found that the volume of wood converted into veneer increased with

increasing log diameters. However, in this study it showed that the recovery percentage or veneer yield based on diameter was found to be insignificant.

Recovery by Log Shape

The recovery of veneer was also classified into log shape (Straight and curve). From the result, it showed that the recovery rate of the straight logs were higher compared to the curved log.

Table 6 : Veneer Recovery by Log Shape

Recovery (%)						
Stages	Log Deck/ Yard	Debarker	Rotary	Dryer	Core builder/composer	Overall recovery
Straight	98.60	97.47	84.62	79.23	62.83	62.83
Curve	98.20	97.36	81.29	73.59	51.96	51.96

Table 6 shows that, veneer recovery rate for straight logs were significantly ($p<0.05$) higher than curve logs from the early stages to the end of veneer processing. Straight logs generated more veneer recovery and less residue losses because they were easier to peel by the rotary lathe, especially at initial stages. The veneers produced were more continuous and contain least amount of defects. The percentage of wood lost through 'rounding-up' was also much less. The results showed that, there were significant differences between the recovery rates based on the shape of the logs.

Residue Losses at Five Earlier Stages

Table 7 : Residue Losses by Species

Residue losses (%)						
Species	Log Deck	Debarker	Rotary	Dryer	Core Builder	Recovery
Meranti	1.30	0.62	13.88	4.72	19.56	58.38
Gerutu	1.3	0.92	13.69	5.37	19.82	58.50
Kapur	2.4	0.58	14.90	7.72	13.91	60.34
Simpoh	1.4	0.92	14.34	8.49	22.44	52.40

Table 7 shows the result of residue losses at each stage for all the species. It can be summarized as follows ;

a) Log yard/deck and debarker section

Residue losses (1-2%) - The residue losses generated were mainly sawdust and end-cuttings which were resulted from cutting bolts into specific length and debarking.

b) Rotary section

Residue losses (14-15%) - At the initial peeling operation, logs were not uniform in shape. Therefore, residue losses in rounding-up process and spur trims in the peeling were produced. At the end of peeling process, the remaining peeler core was removed. Spur trim loss could be reduced by allowing only basic or minimum trimming allowance.

c) Dryer section

Residue losses (5-8%) - Shrinkage losses were due to amount of moisture content loss by the wood.

d) Core builder/composer section

Residue losses (14-23%) - Veneer chips at the dry-end clipper were produced as a result of cutting veneers to uniform shape and size, peeling defect of veneer and presence of natural defects such as knots, by core builder/composer machines.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Generally, veneer recovery was above 50 percent. Kapur had the highest recovery rate, followed by Meranti, Gerutu and Simpoh. Whereas, Simpoh had the lowest recovery rate.

When analysed based on the diameter, diameters above 50 cm generated a higher recovery rate than diameters below 50 cm. In terms of production based on the diameter, it was indicated in this study that the diameter did not influenced significantly the veneer recovery, although there was a trend that larger log diameter resulted in higher veneer output. The difference as observed in the analysis was not significant at the 0.05 percent significant level.

This study confirms the general believe that higher percentage veneer recovery is attainable with straight log shape than curved log. Higher percentage veneer recovery was attained by straight logs than curve log. The straight logs were easier to handle by the machines such as peeling by the rotary lathe during the initial stages.

The study revealed that the major source of residue losses in the veneer manufacturing process was generated at the core builder/composer section, followed by the rotary section, dryer section, log deck and debarker section.

Recommendations

From the study the following recommendations were drawn ;

1. Since the raw material is expensive, it is recommended that the logs be purchased in multiples of block length with minimum allowance. Thus reducing the end-cutting loss in mill yard. The large volume of end-cutting

available was currently being used as solid fuel to generate steam for the veneer dryer.

2. Increased attention should be devoted to the problem of storage of logs. Defects that occur at the log yard or log storage, will affect the quality and quantity of veneer yield.

3. Mills should be using recovery lathe with small chuck diameter in oder to extract more veneers from the large peeler cores.

4. For futher studies, there is a need to analyse the residue losses from the initial stages to the end stages. This is because, not all the residue losses were wasted. Some of them are used as fuel, blockboard and etc. So, these kind of residue should be counted into the recovery rate as recoverable products and not as losses as commonly done.

REFERENCES

Anon., (1976). Veneer Species of the World. An interim report of the International Union of Forestry Research Organisations (IUFRO). Printed on behaif of IUFRO by U.S. Department of Agriculture Forest Service, Forest Product Laboratory, Madison, Wisconsin.

Bailey, T. A. 1975. Veneering and Layup of Tropical Hardwood. Proceding of the First Southeast Asia Sawmill Seminar, Singapore, June 1975; 122pp.

Clark, A. and R.H. McAlister, 1984. Recovery of structural grade veneer from four species of southern hardwoods. For. Prod. J. 34 (5) : 13-20p.

Nazip Suratman, 1988.Plywood Recovery Study. Thesis, B. Sc. (Forestry). UPM. 7pp.

Rast, E. D., D. L. Sonderman and Glenn L. Gammon, 1971. A Guide to Hardwood Log Grading. U.S.D.A Forest Service General Technical Report Ne-1.2-1p.

Wong C.N (1980)- Survey of Plywood Mills in Peninsular Malaysia 1976·*Forestry Dept. Research Pamphlet* No. 76.